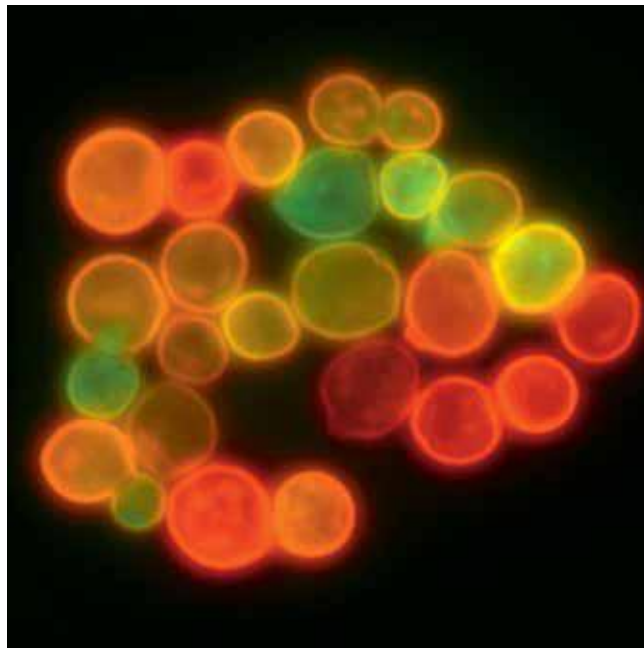


# Broaden the Horizon through Research

280 teams from 30 countries, just as many interesting projects and experiences for the participants: This and more makes up the 'iGEM competition', taking place for the 13th time this year.

by Matthias Tinzl



Visualization of the cell membrane of yeast cells with GFP and RFP fusion proteins

The cryptic acronym iGEM stands for 'international Genetically Engineered Machines', which is almost as unintelligible as the acronym itself. By and large the competition is about groups of students who realize a project in the field of synthetic biology

(see info box), all over the period of a few summer months. To conclude the competition, the results of all team projects are presented in Boston, USA. This year, the ETH is represented as well with a team working on a project to improve the diagnosis of circulating tumor cells in blood samples.

## A great Puzzle of Medicine

Cancer is one of the great mysteries in Medicine. Despite decades of research on the topic and many fundamental insights there is still a huge potential to improve diagnosis and treatment. The problem of cancer research is the fact that cancer is an extremely diverse disease. Tumors not only vary from patient to patient but also from tissue to tissue. However, there are a few properties that many cancer types have in common: Cancer cells enter the vessels of the blood and lymphatic systems as the disease progresses to metastasis. Furthermore cancer cells tend to alter their metabolism: Instead of converting glucose completely to carbon dioxide and water, they stop the -

process at an intermediate product (lactate). In addition, many cancerous cells change the structure and composition of their cell membranes

## A Bacterium is programmed to mark cancer cells

The ETH team exploited these common properties of cancer cells to program the bacterium *E. coli* in a way that makes it a potential tool in a microchip-based detection system for circulating tumor cells. The system functions as follows: A blood sample is treated with sTRAIL, a chemical that induces cancer cells (but not healthy cells) to display a certain phospholipid on its membrane surface. Subsequently, the sample is placed onto a microchip together with the modified bacteria. The bacteria then bind specifically to the exposed phospholipids. If in addition they encounter an elevated lactate concentration they become activated and pass the signal on to neighboring bacteria via a chemical compound. This process is called 'quorum sensing'. Once the bacteria are activated they produce a green fluorescent protein (GFP). If a high fluorescence signal is detected on the microchip one can likely conclude that cancer cells are present in the sample.

Even though the members of the ETH team focused mainly on research, the whole iGEM experience was more than spending a summer at the lab bench. This becomes evident in an interview on the development of the project with Anja Michel.





A good Team: the iGEM-Participants of ETH.

### Your Project sounds very complicated – how many people are currently working on it?

On the one hand we are six Master students: Michael Meier (MSc in Cell Biology), Lisa Baumgartner (MSc in Biochemistry), Harun Mustafa (MSc in Computational Biology and Bioinformatics), Anna Fomitcheva Khartchenko (MSc in Biotechnology), Charlotte Ramon (MSc in Biomedical Engineering) and myself, Anja Michel (MSc in Microbiology and Immunology). Furthermore there are four professors who function as advisers: Sven Panke, Jörg Stelling, Savas Tay and Kobi Benenson. All are associated with the D-BSSE in Basel, where we are doing our lab work too. In addition there are six graduate students who help us perform many of the experiments we have never tried before. Some of them were part of an iGEM team in previous years, which is very helpful.

### How did you come up with the idea of your project?

Well, we started out collecting ideas, quite many initially. Then we checked which ones had already been done by other teams in previous years (a lot of them, actually). After studying the relevant literature we ended up with two ideas, which we developed further in parallel. In May we finally decided to pursue our current project.

### Since when are you working on your Project?

We started with weekly meetings in March and more frequent meetings later on. Since June we are doing lab work. The concluding event is going to take place between September 24 and 28 in Boston.

### If the concluding event is in September I assume that the most stressful time is now. Do some of you also write exams?

All of us have exams to manage in parallel. It certainly creates a lot of pressure. I therefore postponed two exams to the next exam session. Initially we were nine students, but three pulled out shortly after our first meeting. This left the remaining six of us with all the more work to do. I still think the experience is worth every effort. In the regular Master's curriculum we never get the chance to create an own research project from scratch and see it through in a team. We therefore not only gain lab experience but also organizational skills. It is our job, for example, to find and purchase all the materials we need for our experiments. Furthermore, we had a conversation with a person who now directs his own biotech company as a spin-off of the ETH. This was very informative too..

### The topic of this Polykum issue is the 'ETH-Spirit'. Would you say now that you identify more than before with the ETH as a university?

I have always identified with the ETH, especially since I hold my Bachelor of Science title. But now I am all the more proud that we have the honor to travel to Boston in the name of the ETH Zurich to represent our university. It is a bit strange, however, that we are basically doing all the work at the external ETH institute in Basel. Being neighbors with Syngenta and BASF conveys the feeling of working in an industrial park..

### What do you expect from the concluding event in Boston?

Of course we hope that we are going to earn a medal in our track 'Health and Medicine'. There are several tracks to run for and medals are awarded if certain criteria are fulfilled. Within every track there are furthermore a number of achievements that can be earned, for example for the best project idea, the best presentation, the best wiki-page, the best human practices (the idea there is to make people familiar with our project and so on). In any case there is no such thing as a single winner in the end, this is not what the competition is about...

## SYNTHETIC BIOLOGY

Synthetic biology is a relatively young scientific discipline at the interface of biology and engineering. The goal is to create novel functions and artificial biological systems through the (genetic) modification of living cells.